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## CORRELATION OF OSSIFEROUS SECTIONS IN THE UPPER CENOZOIC OF INDIA

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It has been suggested to me that the facts relating to the stratigraphy of the Cenozoic Mammal deposits of India are so scattered in the literature[1] that it is difficult to form a connected idea as to how the various geological sections are correlated to one another, so as to compose in fact a complete ideal section within the period which they cover. To meet this need I have drawn up the accompanying diagram on the model of the table on page 59 of Professor H. F. Osborn's monograph on the Titanotheres,[2] which it is hoped will render the papers quoted more easily intelligible. The individual sections are diagrammatic, inasmuch as no indication is given of the depth of sediment comprised in each; further, although many of the sections are perfectly straightforward, with the strata dipping continuously in the same direction, yet in others simple folding exists, which does not lessen the reliability of our stratigraphical conclusions.

The correlation with the European time scale, which occupies the first column of the table, is the same as that which I have advocated elsewhere.[3] I am aware that this does not find favor with certain palaeontologists, chiefly American. W. D. Matthew[4] in particular wished not only to place the Pinjor and Val d'Arno stages in the Pleistocene, but to assign to the Lower and Middle Siwaliks a later age than that which I consider probable. My arguments in favor of my own view are briefly stated in the above quoted paper and in the British Museum Catalogue of Pontian Carnivora (1931), pp. 151–155,[5] and this is not the place in which to amplify them. In any case we know too little about the origin and migrations of *Hipparion*, *Equus* and *Camelus*, or what American faunas are the exact chronological equivalent of European ones, to render any opinion susceptible of precise proof. The whole question

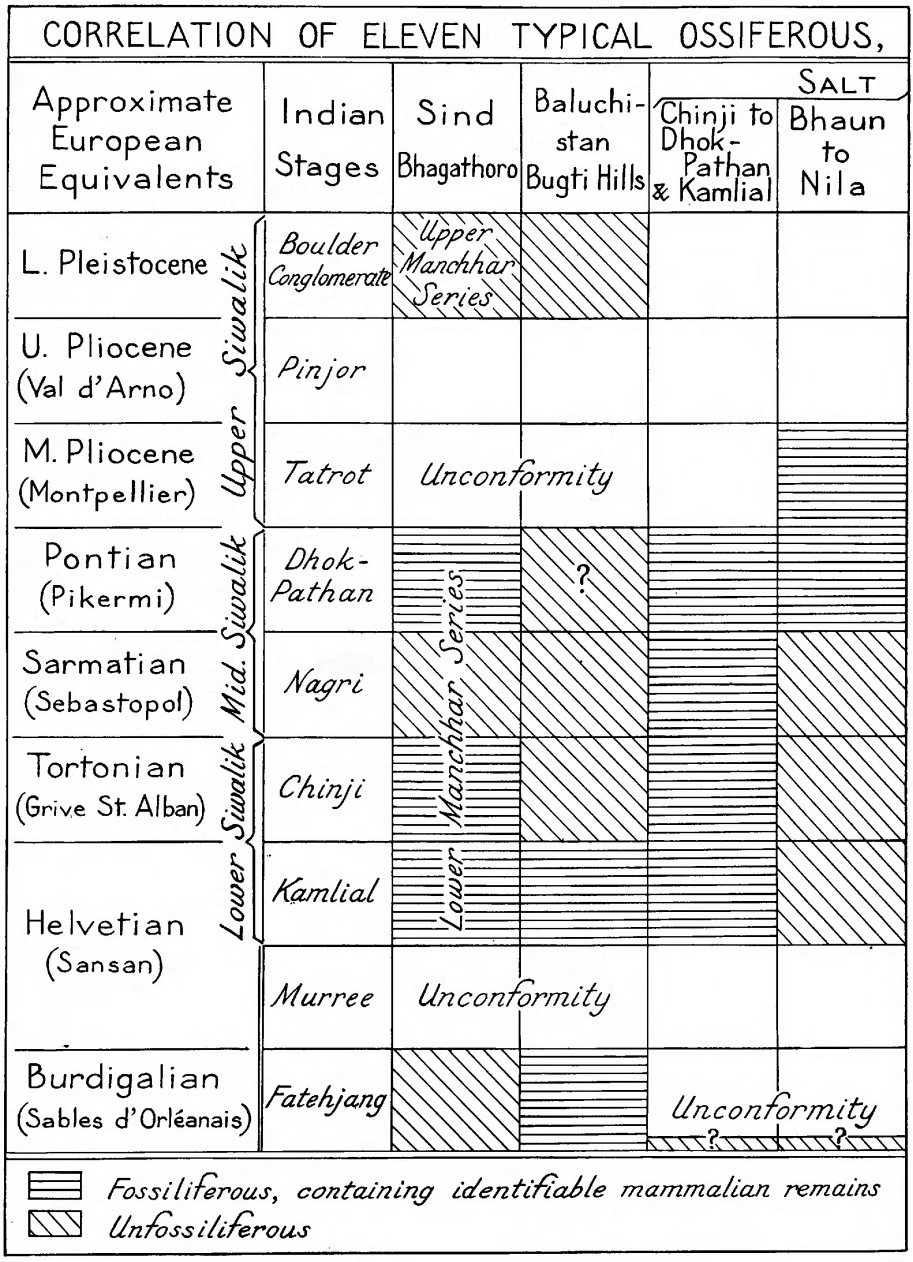
[1]See appended list of publications.

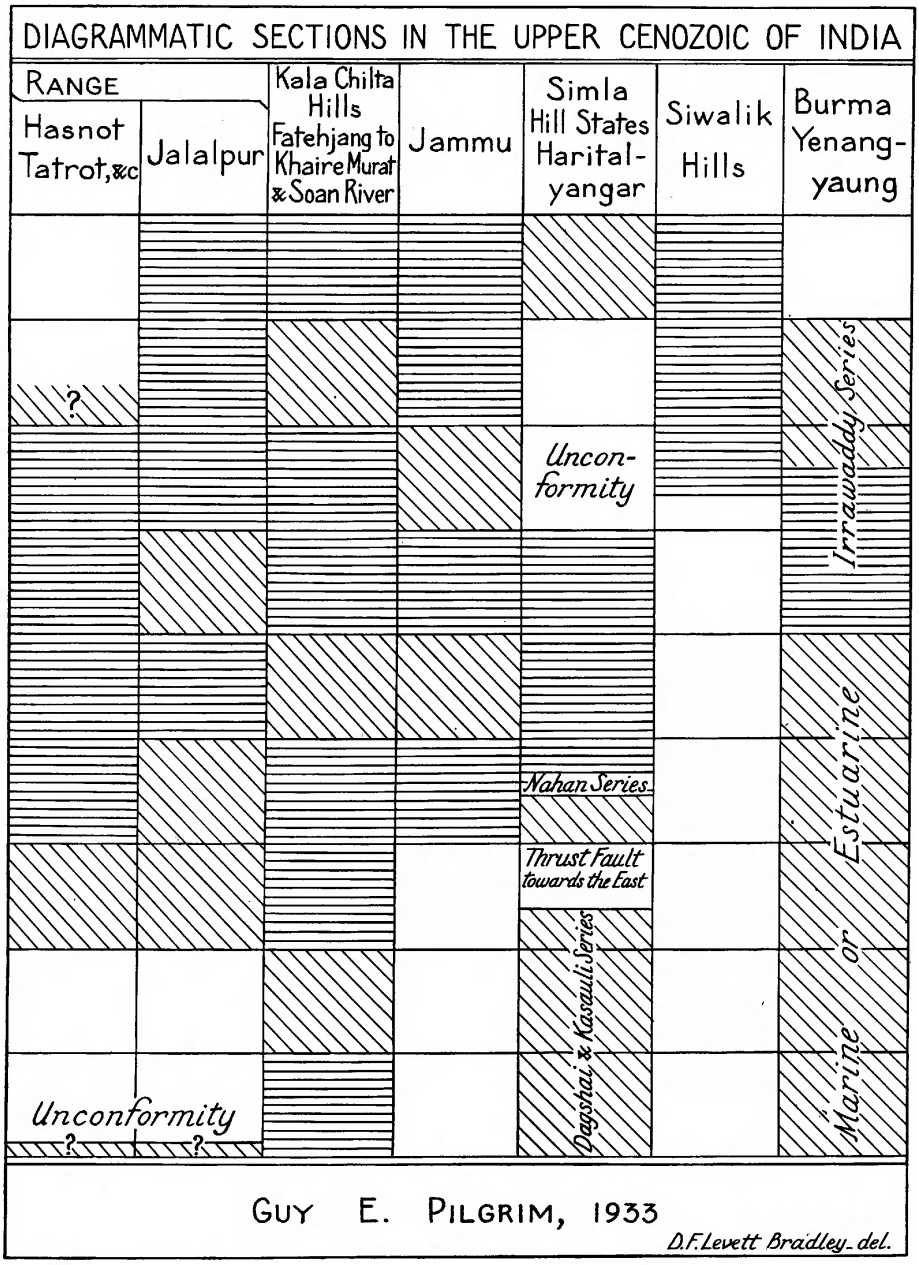
[2]Osborn, Henry Fairfield, 1929. The Titanotheres of Ancient Wyoming, Dakota, and Nebraska. U. S. Geol. Surv. Monograph 55, p. 59.

[3]Pilgrim, G. E. 1932. Fossil Carnivora of India. Pal. Indica, N.S., XVIII, p. 8.

[4]Matthew, W. D. 1929. Critical Observations upon Siwalik Mammals. Bull. Amer. Mus. Nat. Hist., LVI, Art. VII, pp. 438, 441, 442, 445–47, 451.

[5]Pilgrim, G. E. 1931. Catalogue of the Pontian Carnivora of Europe. British Museum (Nat. Hist.), London, England.


CORRELATION OF ELEVEN TYPICAL OSSIFEROUS,
Approximate European Equivalents
Indian Stages
Sind
Bhagathoro
Baluchistan
Bugti Hills
SALT
Chinji to Dhok-Pathan & Kamlial
Bhaun to Nila
L. Pleistocene
Upper Siwalik
Boulder Conglomerate
Upper Manchhar Series
U. Pliocene (Val d'Arno)
Pinjor
M. Pliocene (Montpellier)
Tatrot
Unconformity
Pontian (Pikermi)
Mid. Siwalik
Dhok-Pathan
?
Lower Manchhar Series
Sarmatian (Sebastopol)
Nagri
Tortonian (Grive St. Alban)
Lower Siwalik
Chinji
Helvetian (Sansan)
Kamlial
Murree
Unconformity
Burdigalian (Sables d'Orléanais)
Fatehjang
Unconformity
? ?
Fossiliferous, containing identifiable mammalian remains
Unfossiliferous


DIAGRAMMATIC SECTIONS IN THE UPPER CENOZOIC OF INDIA
RANGE
Hasnot Tatrot, &c
Jalalpur
Kala Chilta Hills Fatehjang to Khaire Murat & Soan River
Jammu
Simla Hill States Harital-yangar
Siwalik Hills
Burma Yenang-yaung
?
Unconformity
Irrawaddy Series
Nahan Series
Thrust Fault towards the East
Dagshai & Kasauli Series
Estuarine or Marine
Unconformity
? ?
GUY E. PILGRIM, 1933
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might be advantageously discussed at an international congress of geologists, and until a consensus of opinion is arrived at in this way, any arguments as to what position should be assigned to individual faunas seem futile.

Reliance is placed chiefly on mammal species for the correlation adopted, though lithological facies is occasionally invoked. It will be noticed over how great a geological period many of the sections extend continuously. In spite of the fact that not all parts of a section are equally fossiliferous, in some cases entirely barren, yet the zoological succession from the Lower Miocene up to the Pleistocene is perfectly clear, in a way that we perhaps find nowhere else in the world for the corresponding period. Two things only militate against a complete picture of the development or arrival on the scene of the Mammal forms of India: 1. Inadequate material; 2. The doubt as to the geological interval between any two successive species. Time will no doubt do much to minimize both these defects. The material collected by Mr. Barnum Brown in India, which has already formed the subject of many papers by himself and by Mr. E. H. Colbert, and one by myself on the Bovidae, not as yet published, seems to offer the first fruits of our extended stratigraphical knowledge, increased material, and intensive palaeontological study.

## List of the Most Important Publications Relating to the Stratigraphy of the Cenozoic Mammal Deposits of India

Cotter, G. de P. 1933. The Geology of the Part of the Attock District West of Longitude 72° 45′. Mem. Geol. Surv. India, LV, Pt. 2, pp. 99–122, 135–136.

Fermor, L. I. 1932. General Report of the Geological Survey of India for the year 1931. Rec. Geol. Surv. India, LXVI, Pt. 1, pp. 118–120.

Pascoe, E. H. 1923. General Report for 1922. Rec. Geol. Surv. India, LV, Pt. 1, pp. 40–42.

Pilgrim, G. E. 1908. The Tertiary and Post-Tertiary Freshwater Deposits of Baluchistan and Sind, with Notices of New Vertebrates. Rec. Geol. Surv. India, XXXVII, Pt. 2, pp. 139–166.

1913. The Correlation of the Siwaliks with Mammal Horizons of Europe. Rec. Geol. Surv. India, XLIII, Pt. 4, pp. 264–326.

1917. Preliminary Note on some Recent Mammal Collections from the Basal Beds of the Siwaliks. Rec. Geol. Surv. India, XLVIII, Pt. 2, pp. 98–101.

1926. The Tertiary Formations of India, and the Interrelation of Marine and Terrestrial Deposits. Proc. Pan-Pacific Sci. Cong., Australia, 1923, pp. 896–931. (Issued 1926.)

1932. The Fossil Carnivora of India. Pal. Indica, N.S., XVIII, pp. 2–3, 6–9.

Pinfold, E. S. 1918. Notes on Structure and Stratigraphy in the Northwest Punjab. Rec. Geol. Surv. India, XLIX, Pt. 3, pp. 149–159.

Wadia, D. N. 1928. The Geology of the Poonch State (Kashmir) and Adjacent Portions of the Punjab. Mem. Geol. Surv. India, LI, Pt. 2, pp. 334–362.

1932. The Tertiary Geosyncline of Northwest Punjab and the History of Quaternary Earth Movements and Drainage of the Gangetic Trough. Quar. Jour. Geol. Min. and Met. Soc. India, IV, No. 8, pp. 69–96.